

Exploration on the Reform of Architecture CAD Course under the 1+X Certificate System

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Abstract—In order to cultivate the composite technical talents in the civil engineering specialty, this work analyzed the problems existing in the teaching model of "Architectural CAD", and proposed the reform of vocational education-oriented teaching goals, the reform of teaching content based on vocational skill level standards, and the reform of teaching methods using advanced mapping technology, explored a new path for teaching reform of "Architectural CAD" under the 1 + X certificate system.

Keywords—*1+X Certification Scheme; Architectural CAD; Curriculum reform; Vocational education*

I. INTRODUCTION

Under the tide of economic reform and development, the demand for talents is imminent, especially for compound skilled talents. At the same time, the structural employment contradictions in China are becoming increasingly serious. The State Council has issued the National Vocational Education Reform Implementation Plan in response to the above issues, initiated the pilot work of the "degree certificate + vocational skill level certificate" (1 + X certificate) system [1], where "1" is a degree certificate and "X" is a number of vocational skill level certificates. This pilot work pointed out the direction for the development of higher vocational education, and also clarified the standards for vocational education personnel training.

The implementation of the 1 + X certificate system is to encourage vocational colleges to improve their competitiveness under the situation of economic structural adjustment, industrial transformation and upgrading, and social and cultural construction. The implementation of the 1 + X certificate system is to comply with the trend of optimization and adjustment of the personnel training structure and achieve the purpose of application-oriented transformation. The implementation of the 1 + X certificate system encourages students to obtain a variety of vocational skill level certificates at the same time as obtaining a diploma, broadening the path for employment.

As an application-oriented undergraduate college, Xi'an Peihua College mainly trains frontline technical personnel with "solid professional skills, strong practical ability and good professional quality" for the society. The "Architectural CAD" course is a professional basic course for civil engineering majors at Xi'an Peihua University. The main teaching goal of this course is to use the drawings commonly used in engineering practice in this specialty as illustrations. Through the lectures in the classroom and exercises that meet the actual

requirements of engineering, students can use CAD drawing software for architectural design, structural design expression, construction drawing, etc., to meet the "actual combat" requirements. Reasons for the implementation of the "Architectural CAD" curriculum reform under the 1 + X certificate system: the curriculum can achieve the goal of professional talent training, the curriculum can meet the graduation requirements, and the corresponding teaching goals can be achieved through the curriculum [2].

II. PROBLEMS IN THE TEACHING MODEL OF ARCHITECTURAL CAD

The "Architectural CAD" course has the following problems in traditional teaching:

A. *Emphasis on systematic knowledge in the discipline*

In traditional teaching, the teaching content is mostly based on basic graphics drawing, and the teaching goals are mostly based on mastering basic operating commands. There are too few studies for complete engineering projects, lack of attention to civil engineering drawing standards and training of civil engineering drawings, and they cannot meet the requirements of solving actual engineering problems.

B. *Emphasize teacher-based knowledge transfer*

In traditional classroom teaching, the first half of the time is mostly focused on explaining various operating commands by the teacher, and the second half of the time is mostly focused on student practice. For the use of operating commands, the students did not think and explore, but simply imitated mechanically. Students did not think through the composition of the overall structure, lacked initiative in learning, and had poor innovation ability.

C. *Emphasize the assessment method that takes the test results as the goal.*

In traditional teaching, architectural CAD courses mostly use the methods of classroom attendance, homework and final test to evaluate students. The electronic version of the homework is easy to copy, so it is difficult for the homework to truly reflect the drawing ability of the students. The final test is limited by the test time. The content of the test is usually simple and cannot reflect the practical application ability of students.

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III. BACKGROUND AND SIGNIFICANCE OF ARCHITECTURAL CAD CURRICULUM REFORM

A. Background

In 2010, the National Outline for Medium and Long-term Education Reform and Development Planning (2010-2020) was promulgated, and it was proposed that under the economic development transformation and industrial structure adjustment, the restructuring of vocational education laid the foundation for talent training, and the scale of vocational education expanded. It shows the vigorous development of China's economy, and the steady development of the employment rate of vocational college graduates reflects the outstanding quality of vocational education. At the same time, it points out the necessity of vocational education reform, and points out that there are some problems in vocational education that need to be resolved: the education certificate issued by the education department and the vocational qualification certificate issued by the human resources and social affairs department is not in a system, and the vocational education diploma and vocational training qualification certificate have been separated.

In the "National Vocational Education Reform Implementation Plan" document issued by the State Council in February 2019, it was proposed that "deepen the reform of the compound technical and technical personnel training model, draw on the general practices of international vocational education and training, formulate work plans and specific management measures, and start the 1 + X certificate. Institutional pilot work." The purpose is to eliminate the long-term accumulation of multiple superimposed contradictions in vocational education development models of scale, extension and resource dependence [3].

B. Meaning

At the moment of industrial transformation, new requirements are put on compound technical talents: understanding the content of on-the-job work, mastering the skills of on-the-job work, sensing the needs of the work object, and having the cooperation of team members.

Under the 1 + X certificate system, the curriculum reform aims at graduation orientation, the integration of production and education as a means, and the common learning of morality and technology as the direction. Curriculum reform has greatly helped the in-depth integration of people and vocations, has a guiding role in improving students' ability to compete in employment, and has also promoted the ability to supply specialized talents in vocational schools[4].

IV. EXPLORATION ON THE REFORM OF ARCHITECTURAL CAD COURSE

A. Teaching goal reform

According to the vocational education training goals of the 1 + X certificate system, Xi'an Peihua College is guided by vocational activities, takes students as the main body, takes quality as the foundation, and aims at competence. The training objective of Xi'an Peihua College is to enable students to master engineering knowledge and the ability to analyze problems. The talent training plan considers the skills training for students to use modern tools and professional specifications

for design and research. The talent training plan emphasizes the skills training of individual and team students to communicate and collaborate to solve engineering problems. In the talent training program, the new technology application of the "Architectural CAD" course and the expansion training of innovative thinking have been increased. The "Architectural CAD" course has become more and more closely related to the subsequent curriculum design, graduation design, and subject skills competition. After the reform, the training objectives of the course changed from adapting to the needs of a single post (drawer) to adapting to the needs of multiple positions (drawer, builder, designer). At the same time, more attention was paid to the cultivation of innovation. The training goals before and after the reform are shown in the Table I.

TABLE I. COMPARISON OF TRAINING GOALS BEFORE AND AFTER THE REFORM

Traditional training goals	Post-reform training goals
Master the basic commands of computer drawing software	Proficient in drawing complete engineering drawings
Master computer basic drawing methods	Proficiency in structural design
Basic computer skills and skills	Ability to innovate and express

B. Teaching content reform

In accordance with the requirements of the State Council's "Notice on Printing and Distributing National Vocational Education Reform Implementation Plan", experts have discussed, revised, and improved the Building Information Model (BIM) vocational skill level standard (hereinafter referred to as the standard)[5].

In terms of teaching content, the standards put forward higher requirements for architectural drafting standards, reading of architectural drawings, and drawing of architectural drawings. Propose strict adherence to national standards and technical specifications, and align the basic principles of engineering drawing with the drawing standards required by enterprises; propose that students integrate into the job environment in advance, adapt to job requirements, complete job tasks, and achieve the job adaptation capabilities and Creative ability; develop students' drawing skills and expand thinking.

Under the 1 + X certificate system, according to the requirements of the building information model (BIM) vocational skill level standard, the "Building CAD" course of Xi'an Peihua College has increased the learning requirements for the student's architectural drawing standards in the teaching content. The requirements for the drawing and identification of axonometric drawings have been increased, and the requirements for the drawing and reading of flat, vertical, sectional and detailed drawings of buildings have been increased. The teaching content ranges from the learning of simple commands in traditional teaching to the integration of cases with a high degree of specialization, which is conducive to strengthening the students' professional drawing skills and practically implementing the goal of cultivating applied, skilled, and compound talents. The training content before and after the reform is shown in Table 2.

TABLE II. COMPARISON OF TRAINING CONTENT BEFORE AND AFTER REFORM

Traditional training content	Post-reform training content
Master the basic knowledge of architectural professional drafting, familiar with fonts, line styles, and proficient in dimensioning.	Master architectural professional drafting standards, master map width, proportion, font, line style, line style, graphic style expression, dimensioning, etc.
Flexible use of menus and toolbars.	Familiar with menus and toolbars.
Familiar with the drawing process of building plans, building elevations, building sections and building details.	Master the drawing of building plans, building elevations, building sections and building details.
	Master the methods of reading and drawing for orthographic, axonometric, and perspective projection (new content).
	Master the method of reading and drawing the plan view, elevation view, section view, cross-section view, partial enlarged view of the body (new content).

C. Teaching method reform

Before the reform, the "Descriptive Geometry and Engineering Drawing" and "Architectural CAD" of the civil engineering specialty of Xi'an Peihua College were merged, and the teaching effect has been not satisfactory for the following reasons:

- Due to the uncertainty in the number of new students, most of the first semester courses are taught by part-time teachers, so it is difficult to guarantee the quality of teaching;
- Most teachers lack a certain engineering background, so teachers mainly conduct classroom teaching and instruct students to complete their homework after class. This form of teaching focuses on the learning and training of knowledge and skills, but the teacher-student interaction is poor, and the time and space for communication are limited;
- In the information age, students' pragmatism has decreased, and eventually the students' "graphics ability", "CAD ability" and "craftsmanship spirit" have generally declined [6].

Under the 1 + X certificate system, in accordance with the training standards of vocational education, Xi'an Peihua College has changed the traditional teaching method and divided "Descriptive Geometry and Engineering Drawing" and "Architectural CAD" into two courses for teaching. "Descriptive Geometry and Engineering Drawing" is arranged in 32 semesters in the first semester, and "Architectural CAD" is arranged in 24 semesters in the fifth semester. The purpose is to allow students to have a basic understanding of drafting and then to study "Architectural CAD" under the support of relevant professional courses, which can better integrate the software with majors.

In terms of teaching methods, Xi'an Peihua College uses mature multimedia technology for teaching and example simulation demonstration[7], combined with advanced mapping technology (BIM virtual, 3D simulation of construction process, VR virtual reality, AR augmented reality)

to make the teaching process more vivid Visual and intuitive. It has played a positive role in eliminating students' fear, stimulating students' interest in learning, and strengthening teaching effects.

The reformed "Architectural CAD" course focuses on cultivating students' engineering abilities and focuses on cultivating students' problem-solving abilities. The curriculum reform has increased the proportion of heuristic and example teaching. By mobilizing the initiative and enthusiasm of students in teaching, the purpose of active learning and independent problem solving is achieved; by gradually explaining difficult and appropriate engineering cases, students' engineering thinking and the ability to comprehensively use professional knowledge are cultivated.

V. CONCLUSIONS

Facing the current shortage of structural talents, vocational colleges should shoulder the burden of cultivating applied talents. CAD technology, as a new technology adapted to modern construction, and as an indispensable tool for engineering and technical personnel, the course reform of "Architectural CAD" should also shoulder the heavy task of reforming the training mode of talents.

Through the study of the "National Vocational Education Reform Implementation Plan", the study of the 1 + X certificate system, and the analysis of vocational education standards, Xi'an Peihua College has implemented the following three aspects of teaching reform in the course of "Architectural CAD":

- Changed the knowledge-oriented and teacher-oriented education concept in traditional teaching. Promote professional activities as the goal and improve the overall quality of students as the goal. Turn the teaching goal to focus on training students' ability to analyze and solve problems.
- According to the assessment requirements of vocational skill level standards, the learning requirements for students' architectural drafting standards have been increased in the teaching content, and the learning requirements for map recognition have been increased. The teaching content is consistent with the company's employment standards, laying a solid foundation for improving students' engineering awareness.
- The use of advanced mapping technology as a teaching method to assist teaching not only helps to expand students' horizons, but also enhances the fun in the teaching process.

Taking the teaching reform of "Architectural CAD" as an example, this article focuses on the teaching reform ideas of Xi'an Peihua College under the 1 + X certificate system from the three aspects of the teaching objectives, teaching content and teaching methods of the course, and gives relevant courses teaching reform. The teacher provided some reference for reference and avoided unnecessary detours.

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